REMARKS/ARGUMENTS

Reconsideration and allowance in view of the following remarks are respectfully requested.

Applicant and the undersigned wish to thank Examiner Olsen for the courtesies extended during the telephone interview of December 8, 2006. The arguments presented during the interview are repeated herein for the record.

Claims 1, 2, 4-6 and 14 were rejected under 35 USC 103(a) as being unpatentable over Tatumoto et al in view of either Kobayashi et al or Nanataki et al with or without evidence from the instant invention or Fujishiro et al. Applicant respectfully traverses this rejection.

The present invention provides a multilayered gas sensing element having a solid electrolytic sheet and an insulating sheet. Each of these sheets is formed from ceramic material(s) such as zirconia, yttria and/or alumina and the ceramic sheets are laminated with one another. Because the materials comprising the ceramic sheets differ from one another, applicant has recognized that it is necessary and desirable to strengthen the bond between the ceramic sheets. To strengthen the bond, applicant provides a gas sensing element wherein a crystal phase containing silicon dioxide is disposed between the ceramic sheets. The silicon dioxide lowers the melting point of the crystal phase. When the ceramic sheets are sintered, the crystal phase is liquefied between the ceramic sheets, so that material transfer is generated between the ceramic sheets via the liquefied crystal phase. Because of this material transfer, the ceramic sheets are tightly bonded to each other following sintering. The crystal phase is formed by liquefying portions of the ceramic sheets that face one another, which in turn causes the material transfer between the portions of the ceramic sheets. Thus, the components of the crystal phase, including silicon dioxide, are originally contained in the respective ceramic sheets.

The Examiner states that "Tatumoto does not explicitly disclose the use of silicon dioxide in the electrolyte". It is respectfully submitted that the Examiner's statement in this regard is misleading. Tatumoto does not merely "fail to explicitly" disclose the use of silicon dioxide. Tatumoto does not implicitly disclose silicon dioxide either. There is simply no teaching or suggestion whatsoever regarding the use of silicon dioxide, much less any teaching of a crystal phase liquefied during sintering so as to generate material transfer as recited in applicant's independent claim 1.

The Examiner cites Kobayashi and Nanataki as teaching the use of silicon dioxide for modifying a thermal expansion coefficient and/or thermal shock resistance. It is respectfully submitted, however, that neither Kobayashi nor Nanataki provide any teaching or suggestion whatsoever with regard to the formation of a crystal phase containing silicon dioxide between a solid electrolytic sheet and an insulating sheet much less that during sintering the liquefied crystal phase generates material transfer between the solid electrolytic sheet and the insulating sheet.

Recognizing the above deficiencies of the Tatumoto, Kobayashi and Nanataki references with respect to the claimed invention, the Examiner cites Fujishiro as allegedly teaching a bonding crystal phase containing silicon dioxide. Applicant respectfully disagrees.

Fujishiro teaches hermetic seal between an electrolyte cylinder 28 and a conductive member 32 or 34. The electrolyte cylinder 28 is formed of ZrO_2–CaO ceramic containing a minor amount of oxides such as SiO_2 and/or $A1_2O_3$. The hermetic seal is attained by preliminarily metallizing surfaces of the electrolyte cylinder 28 and thereafter soldering the conductive member thereto. To metallize the surface of ZrO_2 – CaO ceramics, a paste containing a powdered material such as a mixture of Mo, Mn, Ti; W, MnO_2, and TiO_2 dispersed in an organic solvent is applied onto the surface of the ZrO_2 - CaO ceramics, and the electrolyte cylinder 28 is baked at a temperature of 1200 – 1600 ^{O}C in a hydrogen atmosphere containing steam therein to give a thin metallic

coating on the surface of ZrO_2 –CaO ceramics. To join the electrolyte cylinder 28 to the conductive member, the metallized region of the electrolyte cylinder 28 is plated with nickel, and the similar plated conductive member is joined with the electrolyte cylinder 28 at the plated region by means of a silver-copper or gold-copper solder (see column 5, lines 1-32). The minor amount of oxides are present in the ZrO_2 –CaO ceramics are characterized as present as a secondary phase distinct from the ZrO_2 –CaO ceramics and exhibit strong affinity for the metallic coating (see column 5, lines 21-24).

Therefore, Fujishiro teaches the oxides such as SiO_2 and/or $A1_2O_3$ contained only in ZrO_2 –CaO ceramics, and teaches the oxides exhibiting strong affinity not for another ceramic sheet but for the metallic coating.

As is apparent from the foregoing, however, Fujishiro fails to teach or suggest oxides such as SiO_2 incorporated in ceramic sheet(s) for strengthening a bond between two ceramic sheets, fails to teach oxides formed in a <u>crystal phase</u>, fails to teach oxides originally contained in <u>two sheets</u> to be bonded to each other, and fails to teach material transfer between the sheets via oxides. Thus, Fujishiro does not provide the teachings lacking in the primary three references so as to render the claimed invention obvious. In summary Tatumoto does not provide any teaching or suggestion that the incorporation of silicon dioxide will strengthen a bond between adjacent ceramic sheets, in particular due to the formation of a crystal phase containing silicon dioxide and the material transfer between the ceramic sheets.

For all the reasons advanced above, it is respectfully submitted that the prior art cited by the Examiner does not teach or suggest a multilayered gas sensing element wherein a bond between a zirconia series solid electrolytic sheet and an alumina series insulating sheet is strengthened by a crystal phase containing silicon dioxide formed therebetween during sintering whereby there is material transfer between the respective sheets being bonded.

Claim 3 was rejected under 35 USC 103(a) as being unpatentable over Tatumoto et al in view of either Kobayashi et al or Nanataki et al and further in view of Ishiguro et al. Claim 5 was rejected under 35 USC 103(a) as being unpatentable over Tatumoto et al in view of either Kobayashi et al or Nanataki et al and further in view of JP '409. Claim 6 was rejected under 35 USC 103(a) as being unpatentable over Tatumoto et al in view of either Kobayashi et al or Nanataki et al and further in view of JP '571. Applicant respectfully traverses these rejections. Claims 3, 5, and 6 are submitted to be patentable over the primary combination for the reasons advanced above. The Examiner's further reliance on Ishiguro, JP '409 and/or JP '571 does not overcome the deficiencies of the primary combination noted above.

In view of the foregoing, reconsideration and withdrawal of the Examiner's rejections and allowance of the presently pending claims is solicited.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance and an early Notice to that effect is earnestly solicited.

Respectfully submitted,

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